

Ionizing Radiation Dose Ranges (Rem)



Evidence for small increases in human cancer above 10 rem acute exposure or 20 rem chronic exposure

Typical mission doses on International Space Station (ISS)

Highest air sample .17 mrem

Kerala coast, India high natural bkg/yr

Typical added annual dose for commercial airline flight crews

Airport x-ray whole body scanner: 0.007 mrem/scan (Limit = 25 mrem/yr ≈ 4000 scans/yr)

Round-trip Los Angeles - New York (≈ 3.7 mrem)

Fan swap .005 mrem

Highest Dose Received 7.92 mrem

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Whole body, acute: G-I destruction; lung damage; cognitive dysfunction (death certain in 5 to 12 days)*

Cancer Radiotherapy total doses to tumor

acute exposure = all at once; chronic = hours, days, years

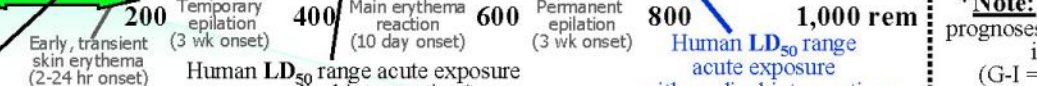
Whole body, acute: cerebral/vascular breakdown (death in 0-5 days)*

Whole body, acute: marked G-I and bone marrow damage (death probable in 1-2 wks)*

*Note: Whole body acute prognoses assume **no** medical intervention (G-I = gastrointestinal)

Charged particle event (Solar flare) dose on moon, no shielding

Estimated dose for 3-yr Mars mission (current shielding)



Medical Diagnostics rads (Estimated maximum organ dose)

X-ray films

A - Chest (PA & Lat)	0.014
B - Dental Panoramic	0.07
C - Lumbar-Sacral Spine	0.2 - 0.3
D - Mammogram	0.2 - 0.4

Radiotracer Imaging

E - Heart Stress (Tc-99m)	0.6 - 1.2
F - Bone (Tc-99m)	0.4 - 1.5
G - Dual Isotope Stress Test	4.0 - 4.5
H - PET: F-18 FDG (bladder)	5.5 - 8

CT Scans (X-ray) (multiple scan average dose)

I - Chest	2 - 3
J - Head	3 - 5
K - Abdominal	2.2 - 6
L - Full Body	5 - 10

Fluoroscopy /Procedures

M - Barium Contrast G.I.	1 - 2.2
N - Cardiac Catheterization	1.2 - 4
O - TIPS Procedure	40 - 140

LD₅₀ = Lethal Dose to 50% (whole body dose that results in lethality to 50% of exposed individuals in 30-60 days)

Dose Equivalent: 100 rem = 1 Sievert = (absorbed dose x radiation quality)

Absorbed Dose: 100 rad = 1 Gray

1 rem ≈ 1 rad for x- and gamma-rays

("≈" stands for "approximately equal to")

Chart compiled by NF Metting, Office of Science, DOE/BER. "Orders of Magnitude" revised June 2010 <http://www.lowdose.energy.gov/>

Source: Office of Biological and Environmental Research (BER), Office of Science, U.S. Department of Energy <http://www.science.doe.gov/ober/>